



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/594,393	09/27/2006	Janet E. Hails	124-1174	9262
23117 7590 01/13/2011 NIXON & VANDERHYE, PC 901 NORTH GLEBE ROAD, 11TH FLOOR ARLINGTON, VA 22203				
EXAMINER				
ENAD, CHRISTINE A				
ART UNIT		PAPER NUMBER		
2823				
MAIL DATE		DELIVERY MODE		
01/13/2011		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/594,393

Applicant(s)

HAILS ET AL.

Examiner

CHRISTINE ENAD

Art Unit

2823

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 December 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 8-22 and 38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 8-22 and 38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-945)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

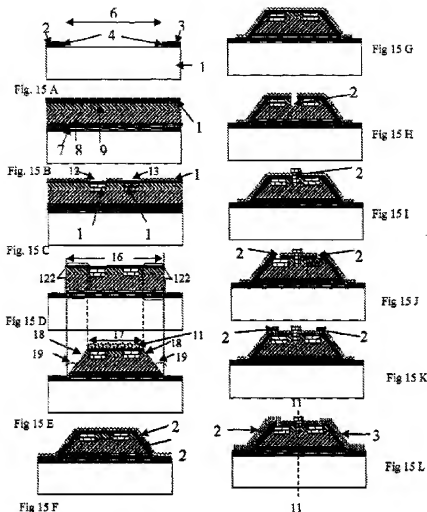
A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/28/2010 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 15-20, 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boieriu et al. (US Publication No. 2003/0102432) in further view of Hoke et al. (US Patent No. 4,804,638).



In re claim 1, Boieriu discloses a method of fabricating an infrared device comprising a cadmium mercury telluride, $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$ where x is $0 \leq x \leq 1$, device layer **Fig 15A-15L**, the method comprising the steps of: a) taking a crystalline silicon substrate 1 (Paragraph 0089), b) growing one or more buffer layers 7 selected from zinc telluride, cadmium telluride and cadmium zinc telluride on said substrate by molecular beam epitaxy to form a buffered silicon substrate (Paragraph 0073, 0089 and 0098), and c) growing at least one device layer of cadmium mercury telluride 9 on the buffered silicon substrate. Boieriu discloses all the limitations except for the growing of the CMT

by MOCVD. Whereas Hoke discloses a method of fabricating a HgCdTe device layer using MOCVD (Column 7, lines 33-52). Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to modify the deposition method of Boieriu and incorporate a metalorganic chemical vapor deposition as an alternative CVD deposition method.

In re claim 15, Boieriu discloses wherein the step of growing the at least one cadmium mercury telluride layer involves doping at least one of the cadmium mercury telluride layers with a dopant (Paragraph 0101).

In re claim 16, Boieriu discloses wherein the dopant is chosen from iodine, arsenic, indium, phosphorous and antimony(Paragraph 0101).

In re claim 17, Boieriu discloses wherein the step of growing at least one cadmium mercury telluride layer comprises the step of growing a plurality of layers of cadmium mercury telluride, at least some of the layers having a different thickness, composition, dopant and/or dopant concentration (Paragraph 0099-0103).

In re claim 18, Boieriu discloses wherein the method further comprises the step of device processing (Paragraph 0112).

In re claim 19, Boieriu discloses wherein the method comprises the step, after the device processing step, of coating the devices with at least one passivating layer (Paragraph 0109).

In re claim 20, Boieriu discloses wherein the at least one passivating layer comprises cadmium telluride (Paragraph 0109).

In re claim 38, Boieriu discloses a method of fabricating an infrared device comprising a cadmium mercury telluride, $\text{Hg}_{1-x}\text{Cd}_x\text{Te}$ where x is $0 \leq x \leq 1$, device layer **Fig 15A-15L**, the method comprising the steps of: a) taking a crystalline silicon substrate **1** (Paragraph 0089) in which the orientation (001) mis-aligned between 1° and 10° towards the [111] direction (Paragraph 0069-0073), b) growing one or more buffer layers **7** selected from zinc telluride, cadmium telluride and cadmium zinc telluride on said substrate by molecular beam epitaxy to form a buffered silicon substrate (Paragraph 0073, 0089 and 0098), and c) growing at least one device layer of cadmium mercury telluride **9** on the buffered silicon substrate. Boieriu discloses all the limitations except for the growing of the CMT by MOCVD. Whereas Hoke discloses a method of fabricating a HgCdTe device layer using MOCVD (Column 7, lines 33-52). Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to modify the deposition method of Boieriu and incorporate a metalorganic chemical vapor deposition as an alternative CVD deposition method.

Claims 8, 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boieriu et al. (US Publication No. 2003/0102432) and Hoke et al. (US Patent No. 4,804,638) as applied in claim 1, and in further view of de Lyon et al (US Patent No. 6,045,614).

In re claim 8, Boieriu and Hoke disclose all the limitations except for the additional buffer layer ZnTe . Whereas de Lyon discloses wherein the step of growing at

least one buffer layer by molecular beam epitaxy comprises the step of growing a layer of zinc telluride on the substrate and growing a layer of cadmium telluride on said zinc telluride layer (Column 6, lines 25-38; Column 7, lines 23-37). Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to modify and incorporate additional buffer layer to maintain the Si substrate orientation and attain thickness uniformity (Johnson S et al (Journal of Electronic Materials, Warrendale, PA, US vol.24, no. 5, 1 May 1995, pages 467-473; Column 12, lines 15-26).

In re claim 10, de Lyon discloses wherein the method further comprises the step, after growing at least one buffer layer by molecular beam epitaxy, of growing at least one buffer layer by metal organic vapor phase epitaxy (Column 6, lines 40-54).

In re claim 11, de Lyon discloses wherein at least one buffer layer grown by metal organic vapor phase epitaxy step is the same as a buffer layer grown by molecular beam epitaxy (Column 5, lines 48-67; Column 6, lines 40-67; Column 7, lines 24-37).

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Boieriu et al. (US Publication No. 2003/0102432) and Hoke et al. (US Patent No. 4,804,638) as applied in claim 1, and in further view of Nouhi A. et al. (Applied Physics Letters, American Institute of Physics, NY, US vol 52, no.24 (1988-06-13; pages 2028-2030)).

In re claim 9, Boieriu and Hoke disclose all the limitations for the cleaning of the layer. Whereas Nouhi discloses prior to the step of growing the at least one layer of

cadmium mercury telluride, of cleaning the surface of the uppermost buffer layer grown by molecular beam epitaxy (Column 2, line 36-Column 3, line 3). Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to incorporate a cleaning step to degrease and remove oxide and contaminants in the layer.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Boieriu et al. (US Publication No. 2003/0102432), Hoke et al. (US Patent No. 4,804,638), and de Lyon et al (US Patent No. 6,045,614) as applied in claim 11, and in further view of Johnson S et al (Journal of Electronic Materials, Warrendale, PA, US vol.24, no. 5, 1 May 1995, pages 467-473).

In re claim 12, Boieriu, Hoke, de Lyon disclose all the limitations except for the growing a further another layer. Whereas Johnson discloses the step of growing at least one buffer layer by molecular beam epitaxy comprises growing a top layer of cadmium telluride on a base layer zinc telluride on the substrate the step of growing at least one further buffer layer comprises growing a further cadmium telluride layer by metal organic vapour phase epitaxy (Column 4, lines 21-40 and Column 5, lines 33-41). Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to modify and incorporate additional buffer layer to maintain the Si substrate orientation and attain thickness uniformity (Column 12, lines 15-26).

Claim 13-14, 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boieriu et al. (US Publication No. 2003/0102432) and Hoke et al. (US Patent No. 4,804,638) as applied in claim 1, and in further view of Hails et al. (US Patent No. 7,026,228).

In re claim 13, Boieriu and Hoke disclose all the limitations except for sequentially growing thin layers of CdTe and HgTe. Whereas Hails discloses the step of growing the at least one cadmium mercury telluride layer comprises sequentially growing thin layers of CdTe and HgTe which interdiffuse during growth to give a single layer of CMT, the relative thicknesses of the CdTe and HgTe layers determining the cadmium content x. (Claim 1 and Column 4, line 64-Column 5, line 8). Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to modify the method of growing cadmium mercury telluride layer to avoid undesirable by products from the precursor (Column 2, lines 37-54).

In re claim 14, Hails discloses di- iso-propyltelluride is the tellurium precursor and dimethylcadmium is the cadmium precursor in the step of growing the at least one cadmium mercury telluride layer by MOVPE (Column 4, lines 1-2).

In re claim 21, Hails discloses the step of coating the device with a passivating layer comprises growing at least one epitaxial layer grown by metal organic vapour phase epitaxy (Column 3, lines 15-25 and lines 55-61).

In re claim 22, Hails discloses the method involves the step, after the device processing step, of growing further epitaxial layers of cadmium mercury telluride by metal organic vapour phase epitaxy (Column 3, lines 45-67).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Zanio et al. (US Patent No. 4,910,154) and Rajavel et al (US Patent No. 5,742,089) disclose HgCdTe detector structures.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHRISTINE ENAD whose telephone number is (571)270-7891. The examiner can normally be reached on Monday - Thursday, 7:30 am - 6:00 pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272 1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew S. Smith/
Supervisory Patent Examiner, Art Unit 2823

CHRISTINE ENAD
Examiner
Art Unit 2823

/C. E./
Examiner, Art Unit 2823